

USER CONTROL DEVICE FOR A TRANSPORTER

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application is a Continuation of U.S. patent application Ser. No. 15/486,980, filed Apr. 13, 2017 and entitled User Control Device for a Transporter, now U.S. Publication No. US-2017-0300058-A1, published Oct. 19, 2017 (Attorney Docket No. V13), which claims the benefit of U.S. Provisional Application Ser. No. 62/322,522, filed Apr. 14, 2016, entitled USER CONTROL DEVICE FOR A TRANSPORTER (Attorney Docket No. R52), which is incorporated herein by reference in its entirety.

BACKGROUND

[0002] The present teachings relate generally to personal vehicles, and more specifically to user control devices for vehicles that have heightened requirements for safety and reliability. Currently, personal vehicles can ascend and descend stairs. Such devices can include a plurality of wheels that can rotate about axes that are fixed with respect to a cluster arm. The cluster arm can rotate about an axis so that wheels rest on successive stairs. Currently, a user can board or disembark from an automobile or other enclosed vehicle and can load a personal vehicle into or out of the enclosed vehicle.

[0003] What is needed is a user control device that can automatically determine locations of key features of the environment of the personal vehicle and can automatically cause the personal vehicle to react to the key features.

SUMMARY

[0004] The user control device of the present teachings can include, but is not limited to including, a user control processor (UCP) assist that can provide enhanced functionality to a user of a personal vehicle such as the transporter of the present teachings, for example, but not limited to, assisting a user of the transporter in avoiding obstacles, traversing doors, traversing stairs, traveling on elevators, and parking/transporting the transporter. The UCP assist can receive user input and/or input from power base processors (PBPs) that can control the transporter, and can enable the invocation of a processing mode that has been automatically or manually selected. A command processor can enable the invoked mode by generating movement commands based at least on previous movement commands, data from the user, and data from sensors. The command processor can receive user data that can include signals from a joystick that can provide an indication of a desired movement direction and speed of the transporter. User data can also include mode selections into which the transporter could be transitioned. Modes such as door mode, rest room mode, enhanced stair mode, elevator mode, mobile storage mode, and static storage/charging mode can be selected. Any of these modes can include a move-to-position mode, or the user can direct the transporter to move to a certain position. UCP assist can generate commands such as movement commands that can include, but are not limited to including, speed and direction, and the movement commands can be provided to the PBPs which can transmit this information to wheel motor drives and cluster motor drives.

[0005] Sensor data can be collected by sensor-handling processors that can include, but are not limited to including, a transporter geometry processor, a point cloud library (PCL) processor, a simultaneous location and mapping (SLAM) processor, and an obstacle processor. The movement commands can also be provided to the sensor handling processors. The sensors can provide environmental information that can include, for example, but not limited to, obstacles and geometric information about the transporter. The sensors can include at least one time-of-flight sensor that can be mounted anywhere on transporter. There can be multiple sensors mounted on the transporter. The PCL processor can gather and process environmental information, and can produce PCL data that can be processed by a PCL library.

[0006] The transporter geometry processor of the present teachings can receive transporter geometry information from the sensors, can perform any processing necessary to prepare the transporter geometry information for use by the mode-dependent processors, and can provide the transporter geometry information to mode-dependent processors. The geometry of the transporter can be used for automatically determining whether or not the transporter can fit in and/or through a space such as, for example, a stairway and a door. The SLAM processor can determine navigation information based on, for example, but not limited to, user information, environmental information, and movement commands. The transporter can travel in a path at least in part set out by navigation information. An obstacle processor can locate obstacles and distances to the obstacles. Obstacles can include, but are not limited to including, doors, stairs, automobiles, and miscellaneous features in the vicinity of the path of the transporter.

[0007] The method for obstacle processing of the present teachings can include, but is not limited to including, receiving movement commands and user information, receiving and segmenting PCL data, identifying at least one plane within the segmented PCL data, and identifying at least one obstacle within the at least one plane. The method for obstacle processing can further include determining at least one situation identifier based at least on the obstacles, user information, and movement commands, and determining the distance between the transporter and the obstacles based at least on the situation identifier. The method for obstacle processing can also include accessing at least one allowed command related to the distance, the obstacle, and the situation identifier. The method for obstacle processing can still further include accessing an automatic response to the allowed command, mapping the movement command with one of the allowed commands, and providing the movement command and the automatic response associated with the mapped allowed command to the mode-dependent processors.

[0008] The obstacles can be stationary or moving. The distance can include a fixed amount and/or can be a dynamically-varying amount. The movement command can include, but is not limited to including, a follow command, a pass-the-obstacle command, a travel-beside-the-obstacle command, and a do-not-follow-the-obstacle command. The obstacle data can be stored and retrieved locally and/or in a cloud-based storage area, for example. The method can optionally include storing the obstacle data and allowing access to the stored obstacle data by systems external to the transporter. The method for obstacle processing can option-